

An Overview of MODIS On-orbit Operation, Calibration, and Lessons

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Two nearly identical copies of the Moderate Resolution Imaging Spectroradiometer (MODIS) have successfully operated onboard the Terra and Aqua spacecraft for more than 11 years and 9 years since their launch in December 1999 and May 2002, respectively. MODIS is a key instrument for the NASA's Earth Observing System (EOS) missions. MODIS observations have produced an unprecedented amount and a broad range of data products and significantly benefited the science and user community. Its follow-on instrument, the Visible/Infrared Imager Radiometer Suite (VIIRS) on-board the NPOESS Preparatory Project (NPP) spacecraft, is currently scheduled for launch in late October, 2011. The NPP serves as a bridge mission between EOS and the Joint Polar Satellite System (JPSS). MODIS collects data in 36 spectral bands, covering spectral regions from visible (VIS) to long-wave infrared (LWIR), and at three different spatial resolutions. Because of its stringent design requirements, MODIS was built with a complete set of onboard calibrators, including a solar diffuser (SD), a solar diffuser stability monitor (SDSM), a blackbody (BB), a spectroradiometric calibration assembly (SRCA), and a space view (SV) port. Except for the SRCA, VIIRS carries the same set of onboard calibrators as MODIS. The SD/SDSM system is used together to calibrate the reflective solar bands (RSB). The BB is designed for the thermal emissive bands (TEB) calibration. Similar to Terra and Aqua MODIS, VIIRS will also make regular lunar observations to monitor RSB radiometric calibration stability. In this paper, we provide an overview of MODIS on-orbit operation and calibration activities and present issues identified and lessons learned from mission-long instrument operations and implementation of various calibration and characterization strategies. Examples of both Terra and Aqua MODIS instrument on-orbit performance, including their similarities and unique characteristics, are discussed in the context of what might be expected from and benefited to the NPP VIIRS operation and calibration. It is anticipated that MODIS experience and lessons will also provide valuable information for other earth observing missions/sensors.